44292

# INSTRUCTION MANUAL

## EMPIRE*

### CLAMP-ON PROBE

### MODELS CP-105 and CP-315

**Serial No.** _____

**Instruction Manual No. 110-5023**

Gertsch*
EMPIRE*
Sensitive Research*
Panoramic*
SINGER

*A Trademark of THE SINGER COMPANY

*Precision electrical and electronic instruments for measurement*

THE SINGER COMPANY • METRICS DIVISION

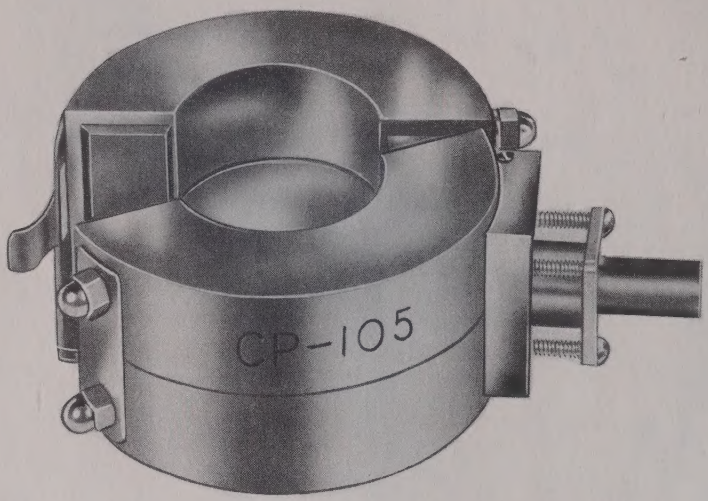


Figure 1. Clamp-on Probe (Model CP-105 shown).

**To the user of SINGER Instrumentation:**

SINGER instruments are fabricated and tested under conditions of rigid manufacturing and quality control according to the best practice of the current state of the art. In addition, our Service and Applications Sections are available to you at any time.

The registration of your instruments and any comments will be most appreciated. The information concerning fields of application will aid us in providing you with pertinent literature from time to time.

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## REGISTRATION CARD

THE SINGER COMPANY
METRICS DIVISION

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**THE SINGER COMPANY**
**METRICS DIVISION**
**915 Pembroke Street**
**Bridgeport 8, Conn.**

## INTRODUCTION

Clamp-on Probes, Models CP-105 and CP-315 (figure 1) are split-core, inserted-primary type RF current transformers. They are designed for use in conjunction with Models NF-105, NF-205, and NF-315 Noise and Field Intensity Meters and other equipments having an input impedance of 50 ohms. The probes permit the measurement of RF currents flowing in conductors or groups of conductors having diameters up to 1-1/4 inches without physically disturbing them. Large power line currents and high voltages have no effect on measurement accuracy. The frequency range is 20Hz to 100MHz. At frequencies above 1MHz, currents may be read directly without the use of charts: from 20Hz to 150kHz, currents may be read by referring to figures 3 and 4.

## TECHNICAL CHARACTERISTICS

| | |
|---|---|
| Frequency range | 20Hz to 100MHz |
| RF current range | 0 to 1 ampere |
| Transfer admittance | 1.0 (+10% -25%) from 150kHz to 100MHz<br>See figure 3 for frequencies from 20Hz to 150kHz |
| Load impedance | 50 ohms nominal |
| Maximum power current | 350 amperes-DC to 1500Hz |
| Maximum power voltage | Limited by conductor insulation |
| Output connector | Type BNC female |
| Dimensions | See outline drawing figure 2 |
| Weight | 15 ounces |

## THEORY

The Clamp-on Probe is an RF current transformer, the primary winding being formed by the conductor under test and a return path such as the equipment frame or a ground plane. Therefore the primary can be considered as having a single turn when the conductor under test passes once through the probe's window. When many conductors pass through the window, the current indicated is the algebraic sum of all the current in the conductors. If an over-all shield braid is used or if a coaxial cable is measured, the indicated current will be that flowing on the outer surface of the shield.

The transformer's core is split into two identical hinged halves. When the halves are closed, insulating material separates the butted ends increasing the core's saturation level. A spring hasp is used to insure that the halves always butt in the same manner.

The primary current ($I_p$) is related to the secondary voltage ($E_s$) by the following equation:

$$I_p = \frac{(E_s)(Y_t)}{N}$$

where: $I_p$ = RF current flowing in primary

$N$ $E_s$ = number or times primary passes through the probe window (normally one)

$Y_t$ = transfer admittance

It can be seen from the equation that the probe's sensitivity can be increased by looping the primary several times through the core. The primary impedance is increased by this method and the measurement accuracy is reduced.

## OPERATION

Spring back the hasp to open the probe and place it around the conductor or conductors to be measured. Close the probe firmly until the hasp snaps shut.

Do not permit the probe to touch the metal parts of any equipment, shield braid or the ground plane as ground loops formed in this manner will affect measurement accuracy. Care should also be exercised to maintain sufficient insulation between high voltage conductors and the probe's case.

Often standing waves will exist along the measured conductor. A true measure of the current flowing can only be made by taking readings at intervals along the conductor.

At frequencies above 25MHz, the measurement accuracy will be improved when the conductor under measurement is centered within the opening in the probe's window.

## NARROW BAND MEASUREMENTS

1. Calibrate the Noise and Field Intensity Meter as a two-terminal RF voltmeter as outlined in its instruction book.

2. Connect the current probe.

   a. Above 150kHz the transfer admittance ($Y_t$) equals one. Therefore the equipment will indicate directly in microamperes or in db above one microampere instead of microvolts or in db above one microvolt (i.e.: 100 uv indicated means 100 ua is flowing in the conductor being measured).

b. Between 20Hz and 150kHz the transfer admittance read from chart (figure 4) should be added to the reading in db above one microvolt.

Example: Frequency = 20kHz

Meter Reading = 1000 uv = 60 dB above 1 uv

$Y_t$ @ 20kHz (from figure 4) = 11.0 dB above 1 Siemen (mho)

Therefore:

$I_p$ = 60 + 11 = 71 dB above 1 ua

**BROADBAND MEASUREMENTS**

These measurements should be made by the substitution as outlined in the instruction book for the Noise and Field Intensity Meter.

Example: Frequency = 20kHz

Meter Reading = 80DBMHZ

$Y_t$ @ 20kHz (from figure 3) = 11 dB above 1 Siemen (mho)

Therefore:

$I_p$ = 91 dB above one microampere per megahertz

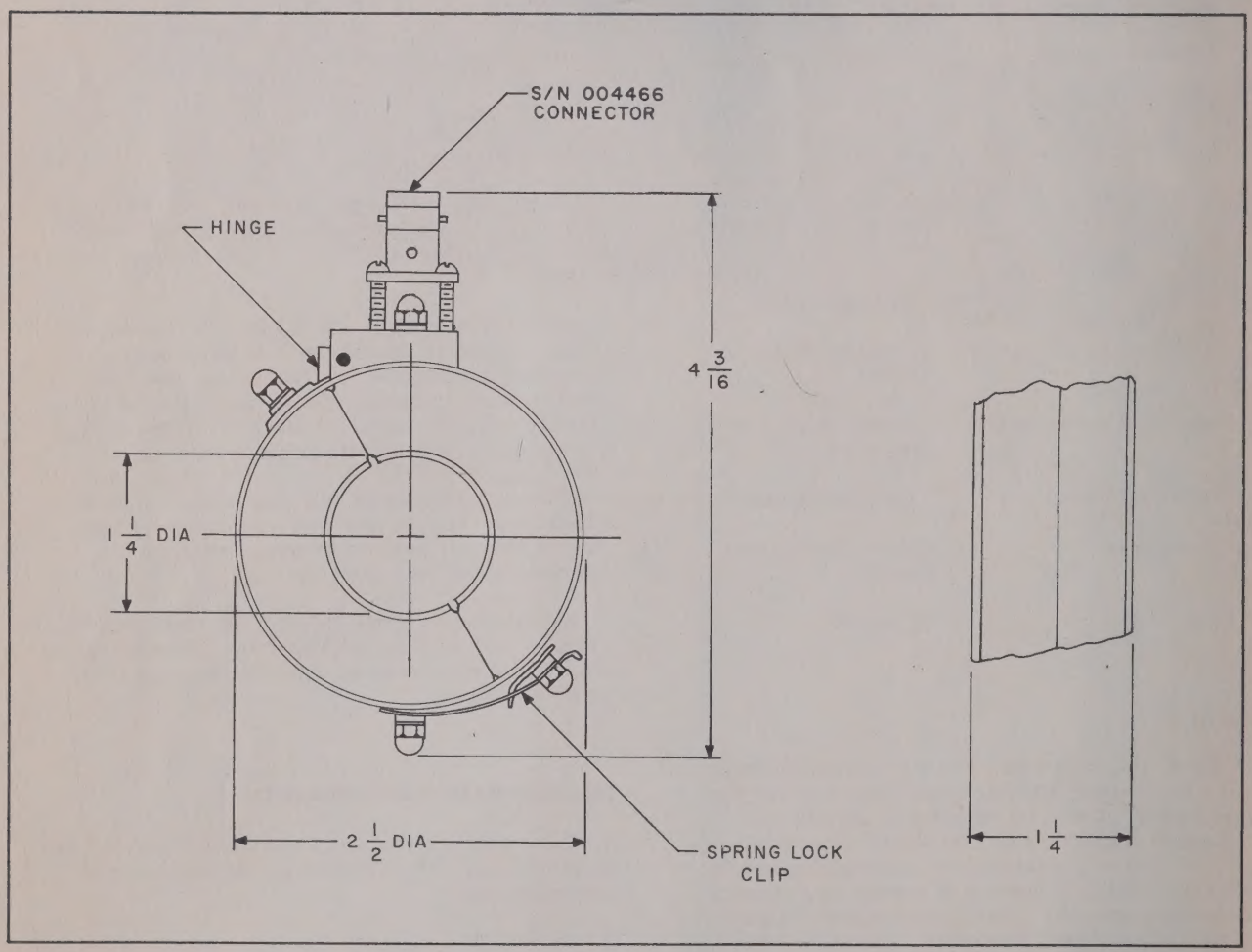


Figure 2. Outline Drawing.

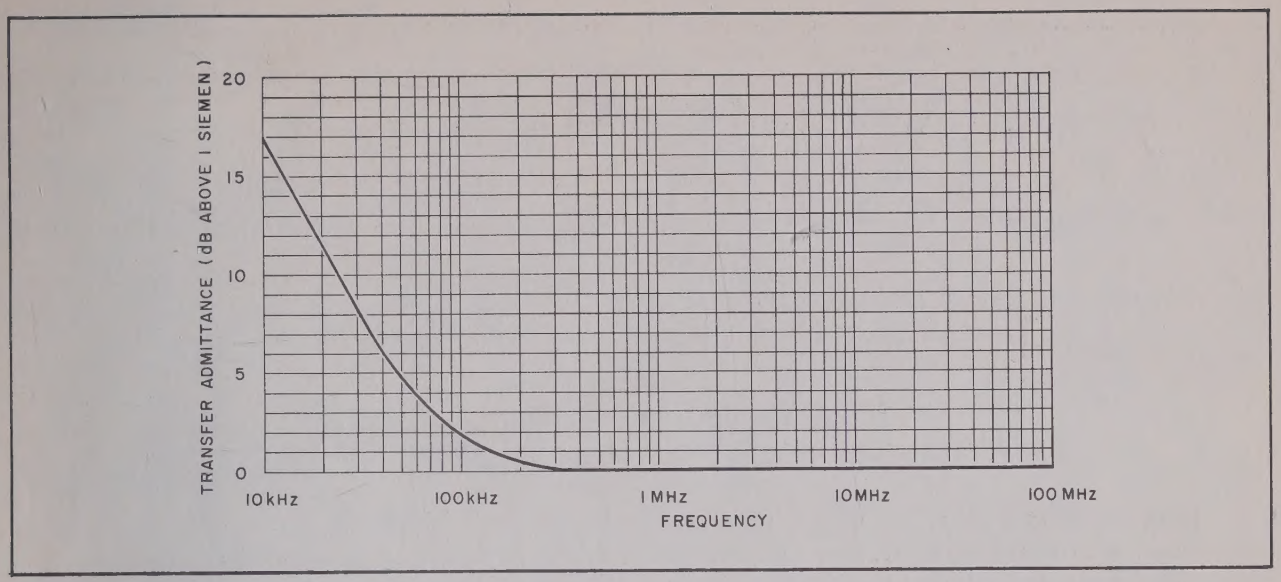


Figure 3. Transfer Admittance vs. Frequency (10kHz to 100MHz)

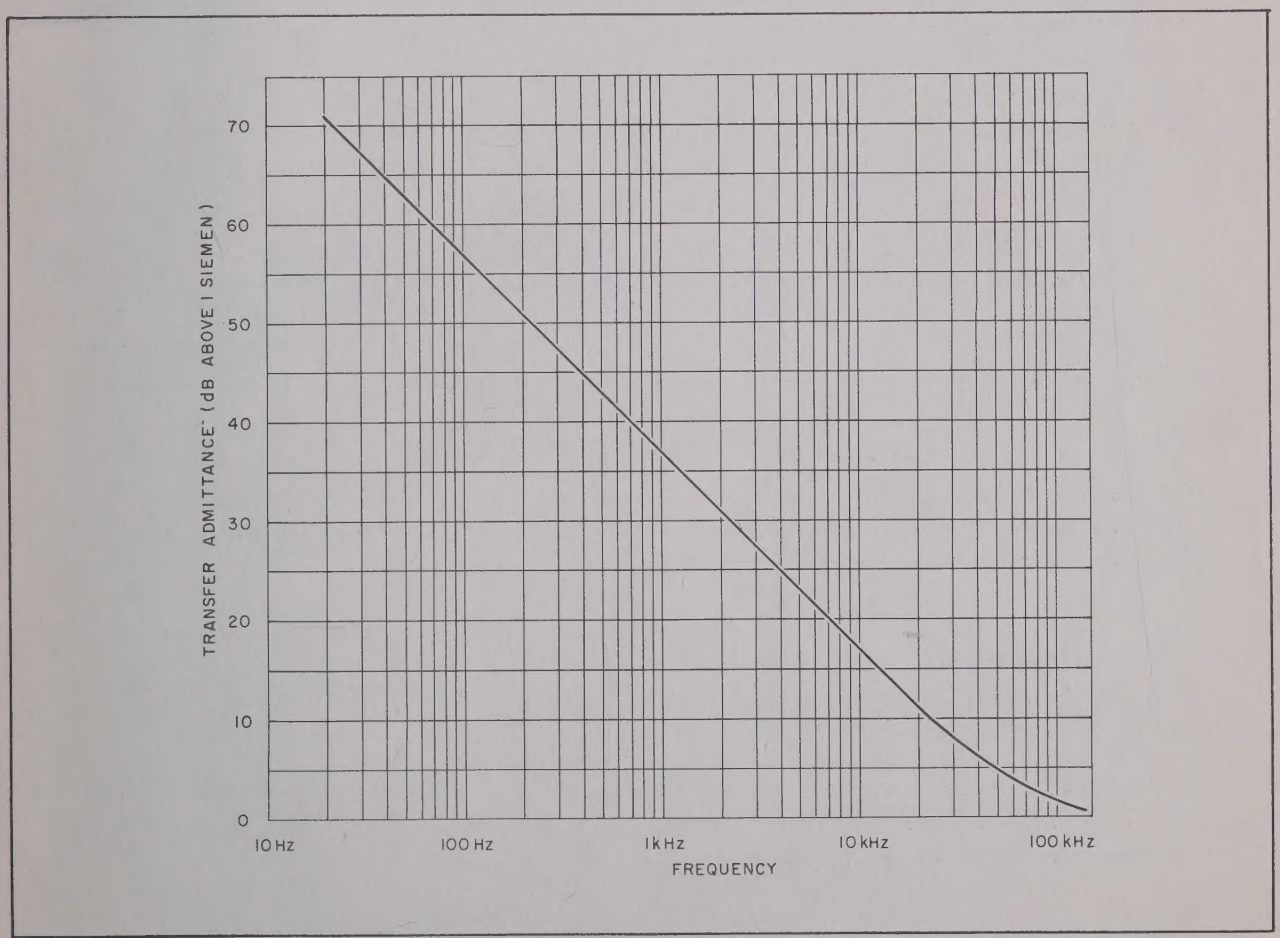


Figure 4. Transfer Admittance vs. Frequency (20Hz to 150kHz)

# WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Sensitive Research** Electrical Indicating Instruments.....2 years
Other Electrical and Electronic Measuring Instruments.....1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuses, lamps, thermoelements, and *RatioTran** potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other obligations or liabilities expressed or implied and The Singer Company neither assumes, nor authorizes any person to assume for them, any other liability in connection with sales of instruments manufactured by The Singer Company, Metrics Division.

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## REPAIR AND MAINTENANCE

Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Empire**, *Panoramic**, and *Sensitive Research** instruments.
Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.